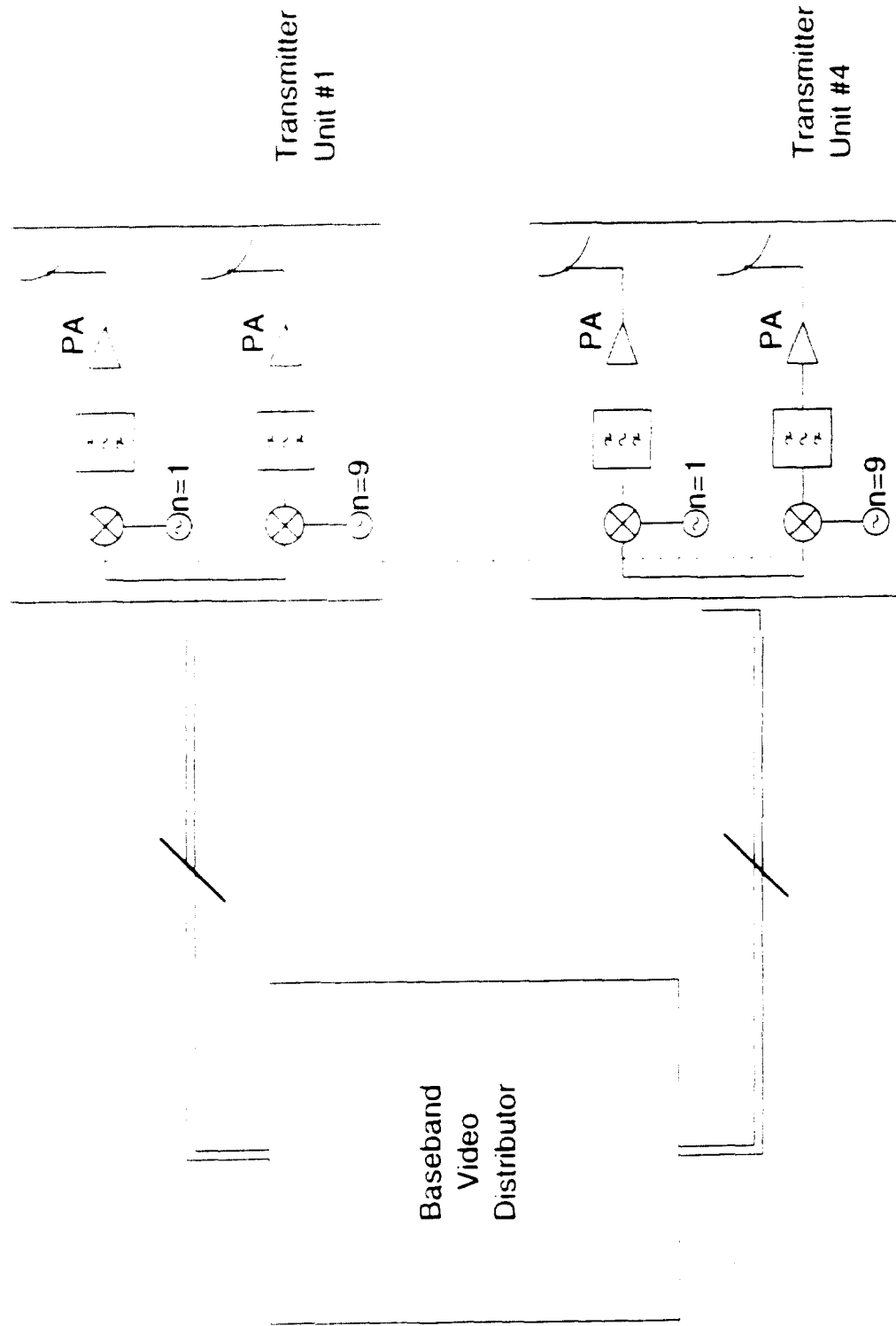


## **Current MVDS Equipment**

- **PHILIPS Transmitter Unit specification**
  - **4 transmitter units, each with 8+1 (redundant ) transceiver**
  - **Redundant transmitter on Hot Standby (200 MHz bandwidth)**
  - **Seperate transmitter for each channel**
  - **PA technology MMIC GaAs pHEMT - Power is 23 dBm per channel**
    - **cost approx £800 each in volume**
  - **By 1996 transmitter powers of 1 Watt per channel could be available**
  - **Horn Antenna for each channel => 15 dB gain**
  - **Cost estimate: £33,000-£57,000 for transmitter station**

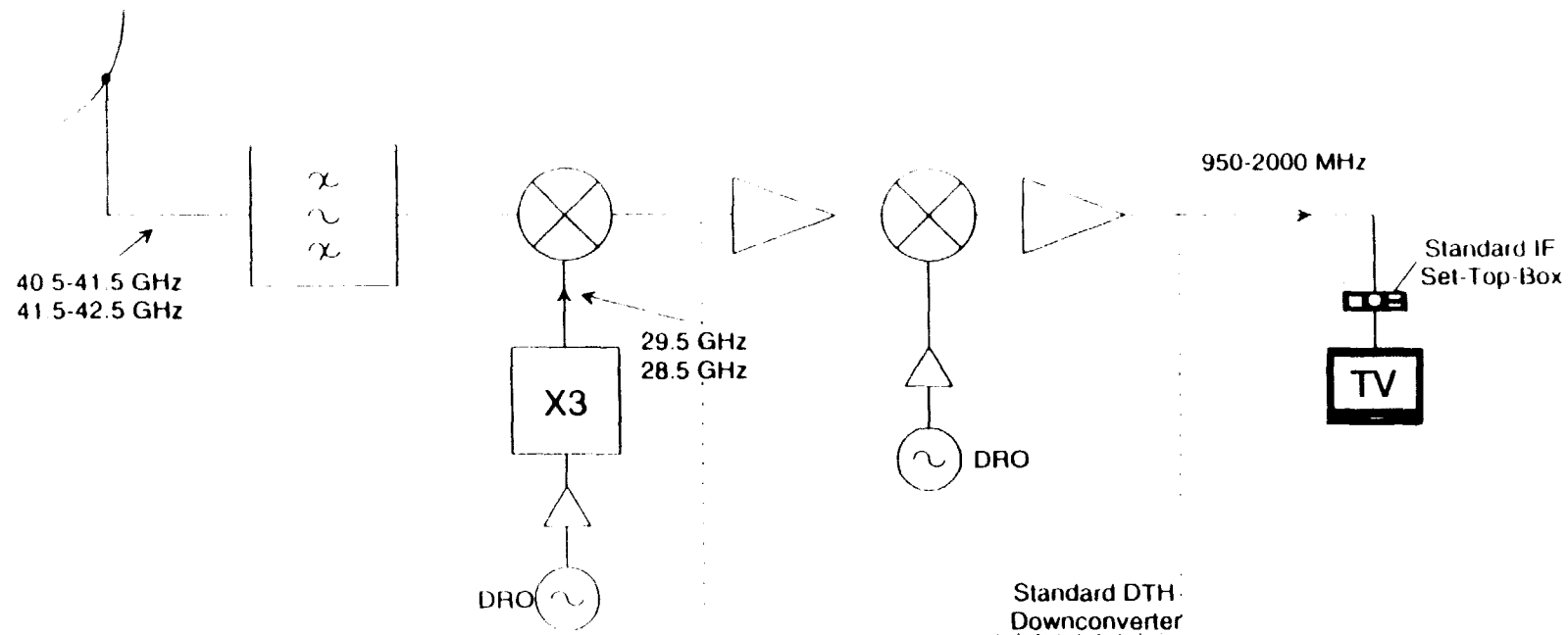
# Philips Transmitter Unit

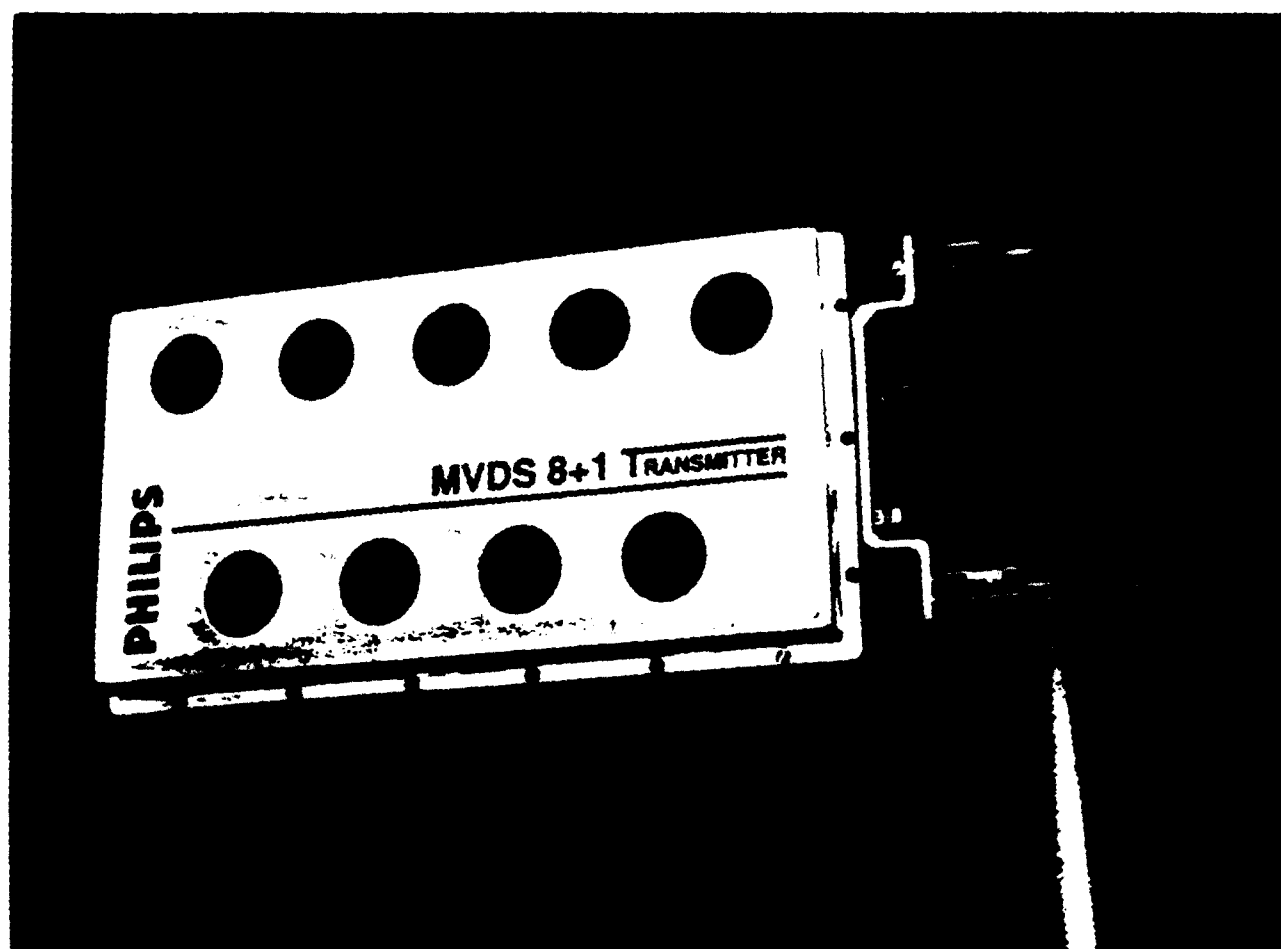


## **Current MVDS Equipment**

- **Receiver Unit**
  - **Based on commercially available satellite DTH Downconverter**
  - **Extra downconversion stage from 40 GHz to 12 GHz (1st IF)**
  - **2nd IF: 950 - 2000 MHz**
  - **2nd IF fed into standard satellite DTH receiver set-top box**
- **Rx Antenna**
  - **Horn Antenna**
  - **Small size - low cost**
  - **High Gain (32 dBi) so eliminates need for LNA in Receiver**
- **estimated cost for 40 GHz MVDS receiver (excluding indoor set-top box) is £65 - £130**

# Philips Receiver Unit





## **Current MVDS Equipment**

- **Other Hardware Providers**
  - **GEC Marconi, UK**
    - **Working on 40 GHz MVDS demo, available June 1995**
    - **On target for production late 1995**
  - **40 GHz components available from a number of suppliers:**
    - **Farran Technology, Ireland**
    - **Thompson CSF**
    - **RACAL**

## **SUMMARY**

- **Philips are developing 40 GHz equipment which will be available in production by August 1995**
- **Eurobell intend to use Philips equipment in their local delivery franchise which will begin in 1996**
- **Digital MVDS is currently being developed which can provide approx 300 channels in 1 GHz**
  - **Philips plan to have this 40 GHz digital equipment in production by end of 1996**



**SPACEWAY™**

Providing Affordable  
Telecommunications Solutions

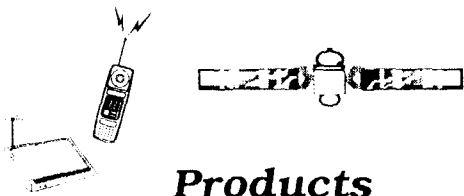
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April 1995



# Hughes Is a Global Wireless Telecommunications Provider

**HUGHES**



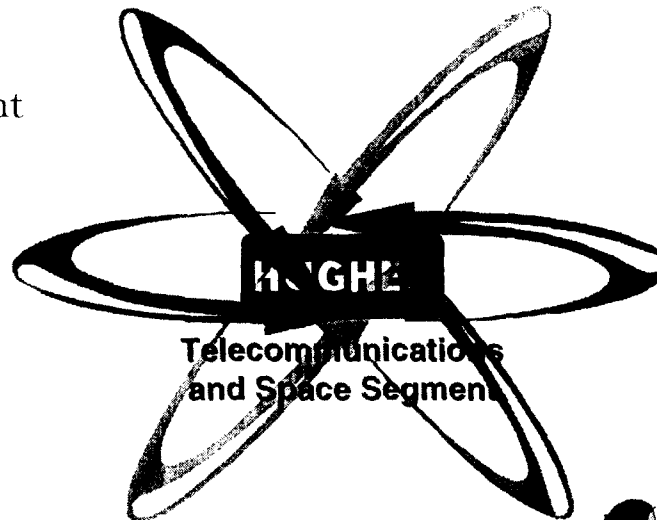
## **Products**

- Satellites
- Digital cellular equipment
- VSAT networks



## **Services**

- Satellite system operator
- Leasing for government applications
- Business systems integrator
- Direct-to-home television entertainment
- Mobile satellite service provider

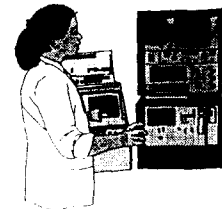


## **Markets**

- Telecommunications equipment in use in 45 countries

## **Technologies**

- Digital direct broadcast television
- Space-based digital processing
- ETDMA
- Fixed Wireless
- Local area networks and internetworking

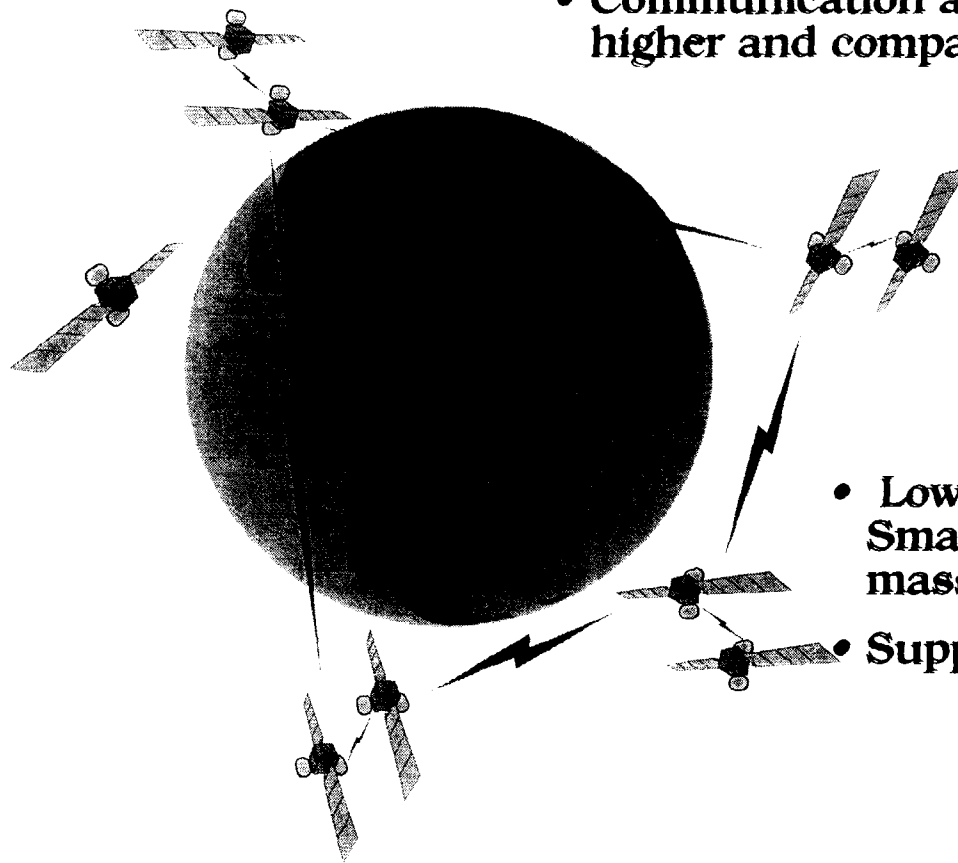


***Hughes is a world leader in many of the products and services we provide.***

# SPACEWAY™ Overview

**HUGHES**  
COMMUNICATIONS  
A unit of GM Hughes Electronics

- Provides worldwide “bandwidth on demand”
  - Interactive, digital, low cost, Ka-band communications services: voice, data, images and video
- Communication at rates from 16Kbps to 1544 Kbps and higher and compatible with terrestrial services



- Multiple Satellite constellation serving four interconnected regions:

North America, Asia Pacific,  
Central/South America, and  
Europe/Africa

- Service initiates 1998: global coverage in place by 2000
- Low cost (<\$1,000), easily installable Ultra Small Aperture Terminals (26") accessible to mass markets
- Supports over 5 to 10 million subscribers

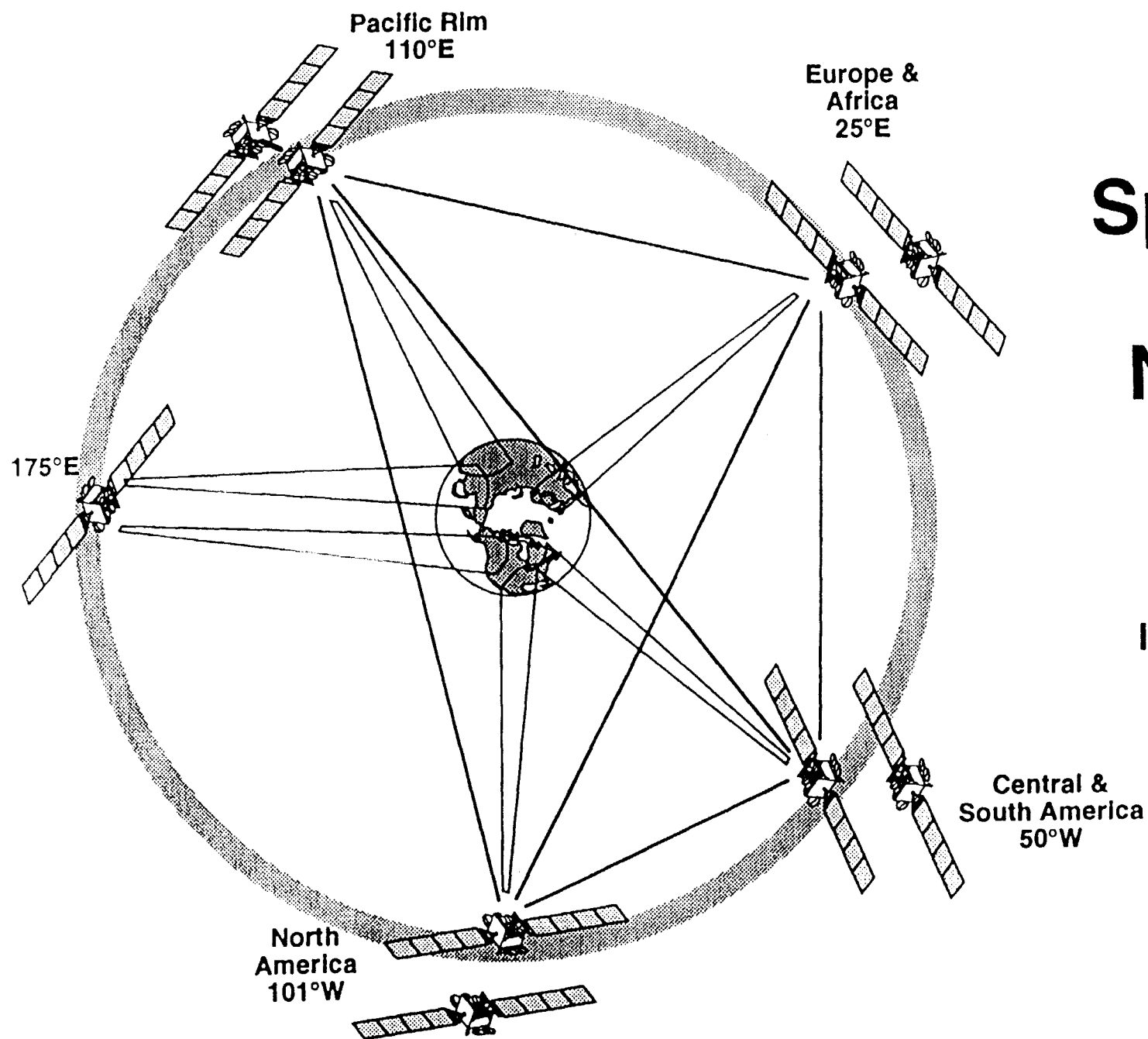


Figure 1.

# Spaceway Global Network

Phase 1

Orbital  
Locations

Initial Operating  
Capability

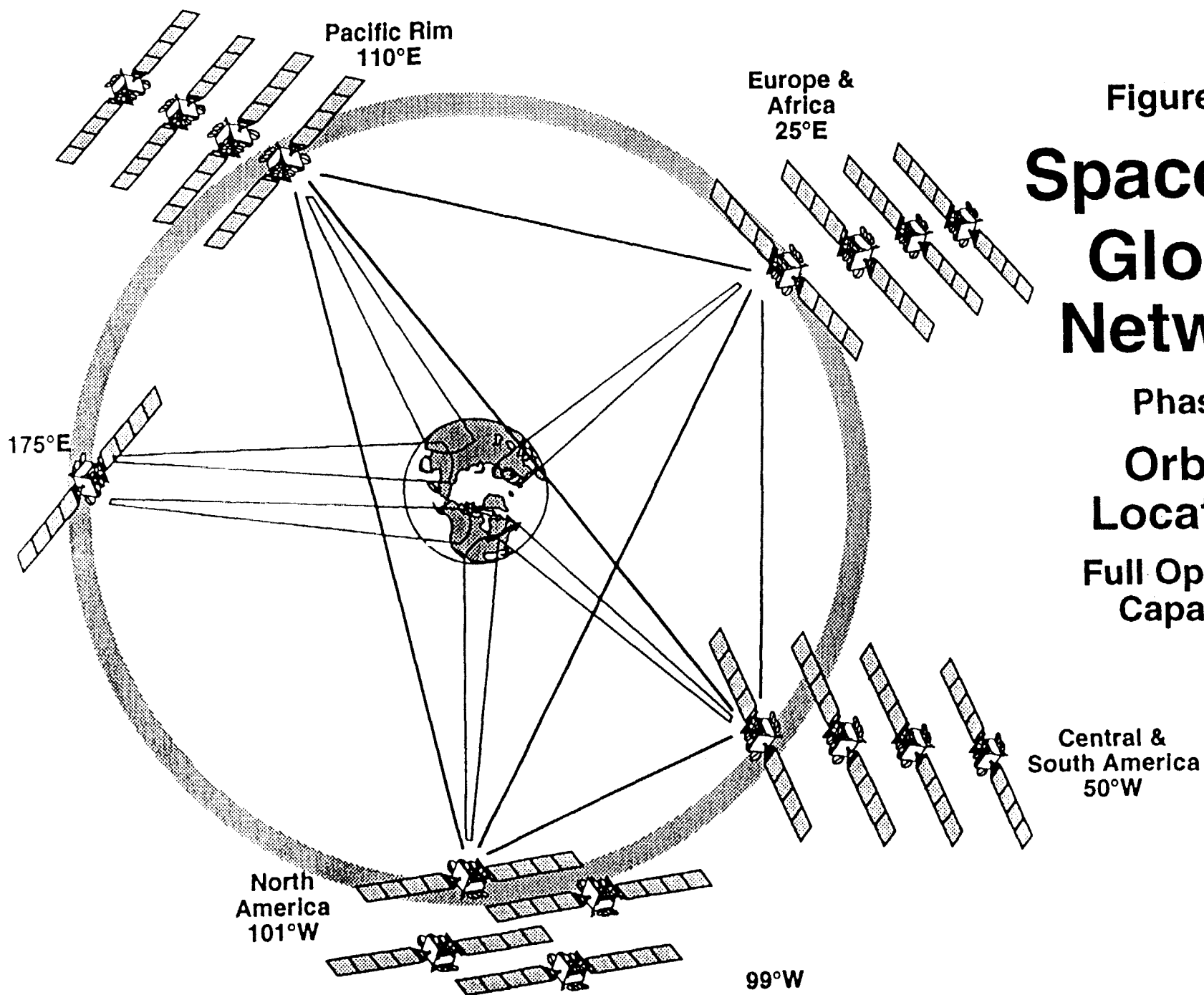


Figure 1A.

# Spaceway Global Network

Phase 2  
Orbital  
Locations  
Full Operating  
Capability

# SPACEWAY™ IS A UNIQUE SATELLITE SYSTEM

**HUGHES**  
COMMUNICATIONS

19 APRIL 1995

## MARKET BENEFIT

- **AFFORDABLE SERVICE**
  - LOW COST
  - PAY FOR WHAT YOU USE
- **WIDE RANGE OF APPLICATIONS**
  - TELEPHONY
  - POINT OF SALE
  - VIDEO CONFERENCING
  - REGIONAL DTH
- **FULL CONNECTIVITY**
  - POINT-TO-POINT
  - LAN
  - MULTICAST / BROADCAST

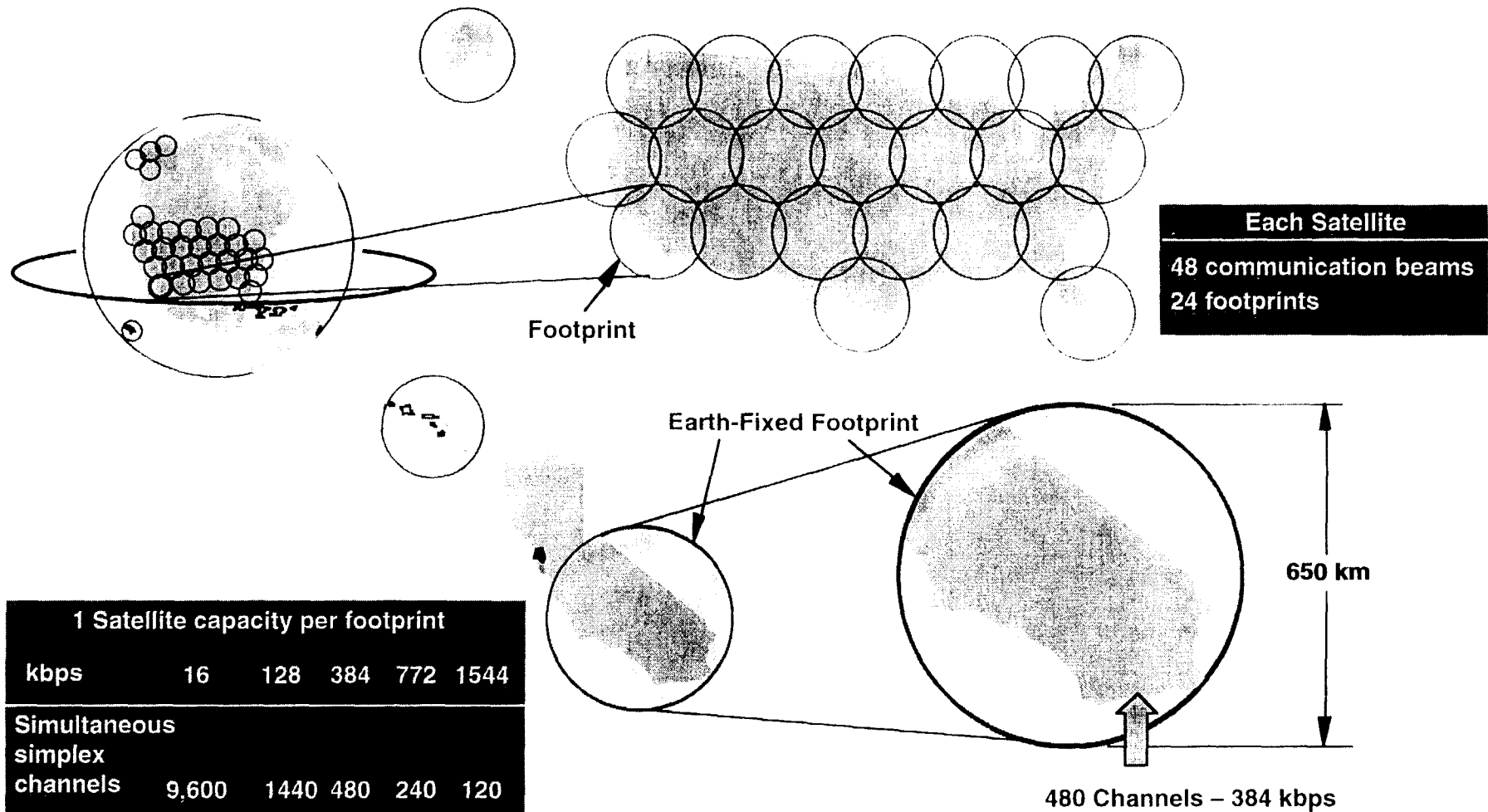
## SPACEWAY™ ARCHITECTURE

- **SPOT BEAM ARCHITECTURE**
  - LARGE SYSTEM CAPACITY
  - TWELVEFOLD FREQUENCY REUSE
  - SMALL TERMINALS / NEXT GEN VSAT
- **BANDWIDTH ON DEMAND**
  - FAST PACKET SWITCHING
- **WIDE RANGE OF DATA RATES**
  - 16 Kbps TO 1.5 MBps (20 MBps)
  - CONSTANT BIT RATE / BURSTY SERVICES
  - 92 MBps DOWN LINK
- **ON BOARD ROUTING**
  - SINGLE HOP BEAM-TO-BEAM
  - FULL MESH CONNECTIVITY
  - ATM COMPATIBLE

# SPACEWAY™

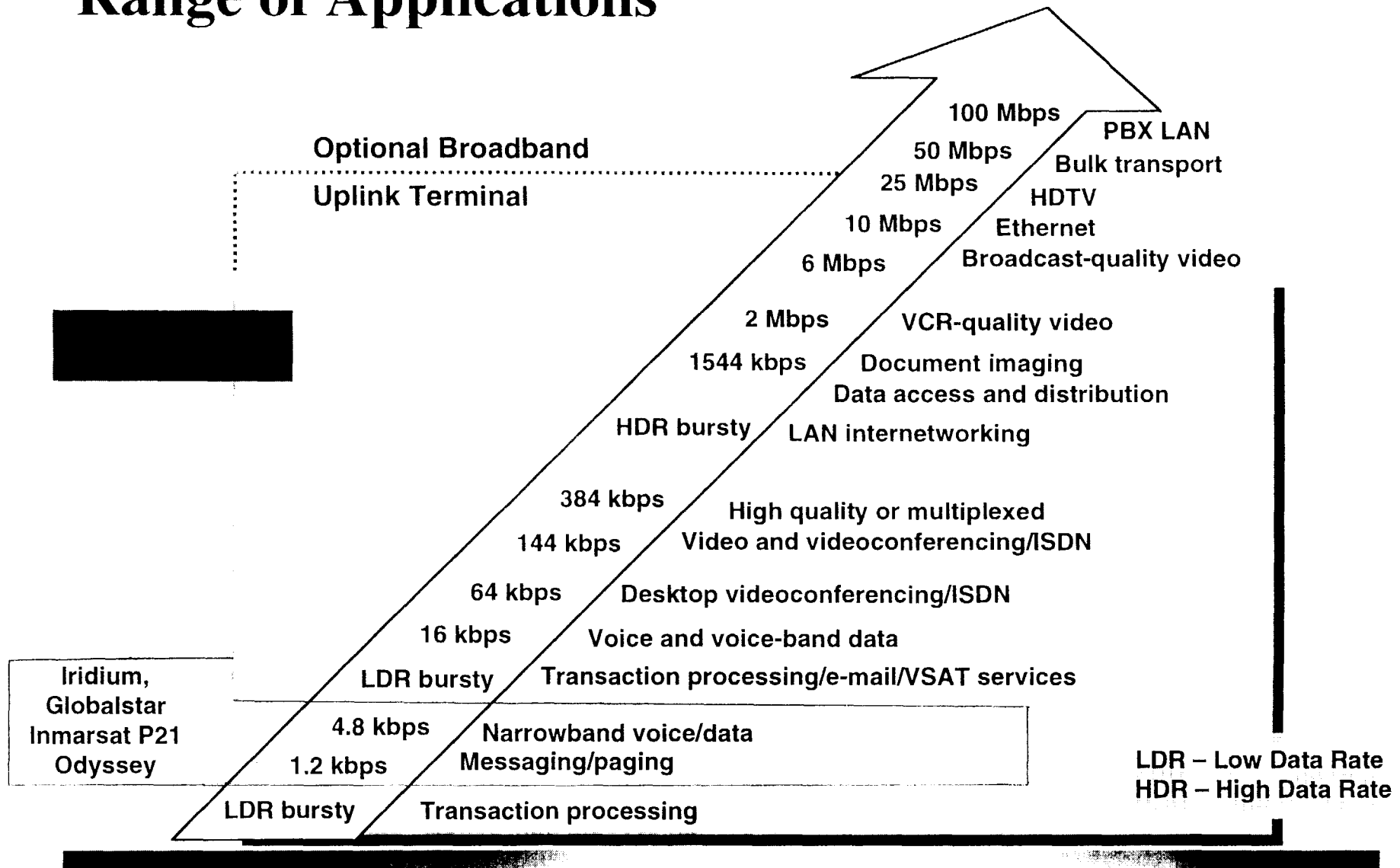
Spot Beam Technology Permits High  
Frequency Reuse and High System Capacity

**HUGHES**  
COMMUNICATIONS



# SPACEWAY™ Enables a Wide Range of Applications

**HUGHES**  
COMMUNICATIONS



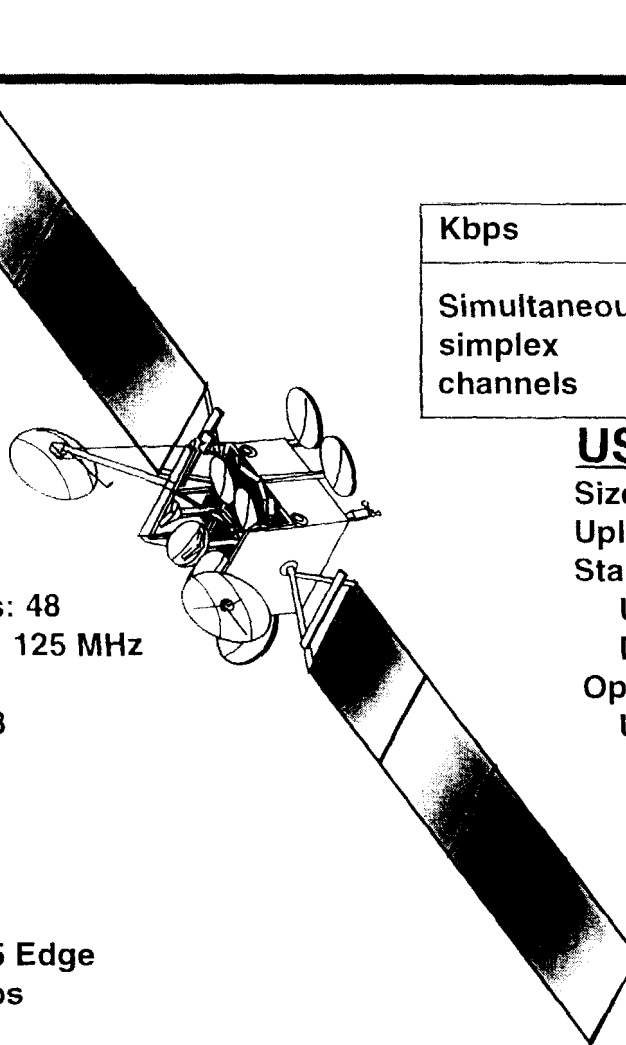
# SPACEWAY™

## Performance Summary

**HUGHES**

### Satellite

Type: HS601  
Lifetime: 15 yrs  
Dry weight: 3,785 lbs  
Eclipse capacity: 100%  
Bandwidth: 500 MHz  
Number of communication beams: 48  
Communication beam bandwidth: 125 MHz  
BER performance:  $1 \times 10^{-10}$   
Transmitter redundancy: 64 for 48  
Modulation: QPSK  
Data stream: FDM/TDMA Uplink  
TDM Downlink  
Data throughput: 4.6 Gbps  
Downlink data rate: 92 Mbps  
Downlink EIRP: 60 (dBw) Peak; 55 Edge  
Inter satellite links: 60 GHz; 1 Gbps



### Capacity per satellite

Kbps	16	128	384	1,544	2,048
Simultaneous simplex channels	230,400	34,560	11,520	2,880	2,304

### USAT

Size: 66 cm to 2 m  
Uplink power: 0.1w to 2.0 w  
Standard Terminal:  
Uplink data rates: 16 kbps to 1.544 Mbps  
Downlink data rates: 16 kbps to 92 Mbps  
Optional Uplink Terminal:  
Uplink data rates: Up to 6 Mbps





# SPACEWAY™ Services are Market-Focused



## Infrastructure Enhancement

- Rapid build-out →
  - Available 1998
- High quality →
  - Digital transmission quality
  - Significantly superior to mobile alternatives
  - Echo cancellation
  - 16 Kbps toll quality voice
- Ease-of-use →
  - Seamless terrestrial interconnectivity
  - Local, long distance, international connections
- Lower cost →
  - High system capacity
  - Regional implementation
  - Mass produced USATs
  - Service charges competitive with terrestrial wireline

## Interactive Multimedia

- Rapid deployment →
  - Simple rapid installation: "One stop shop"
- Bandwidth-on-demand →
  - Versatile service offerings; usage based pricing
- High data rates →
  - Up to E1 (2.048 Mbit/sec) 20 Mbps with optional uplink terminal
- Compatible with latest terrestrial technology →
  - ATM
  - Frame Relay
  - ISDN
  - Videoconferencing
- High quality →
  - Greater than 99.5% availability
  - BER comparable with terrestrial ATM (fiber)
- Lower cost →
  - Lower priced equipment and service than terrestrial alternatives

*SPACEWAY™ flexibility allows the system to evolve as markets develop, shifting seamlessly between voice and wideband telecommunications.*

---

# **SPACEWAY™ Provides High Quality Telephony Service**

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**HUGHES**

## ***Cost Effective***

**Competitive with terrestrial alternatives in many areas.**

**Affordable service to underserved.**

## ***Modest Delay***

**Single hop delay less than 320 ms**

## ***No Echo***

**All digital technology incorporates echo cancellation**

## ***High Quality***

**16 Kbps ensures much better voice quality than mobile alternatives**

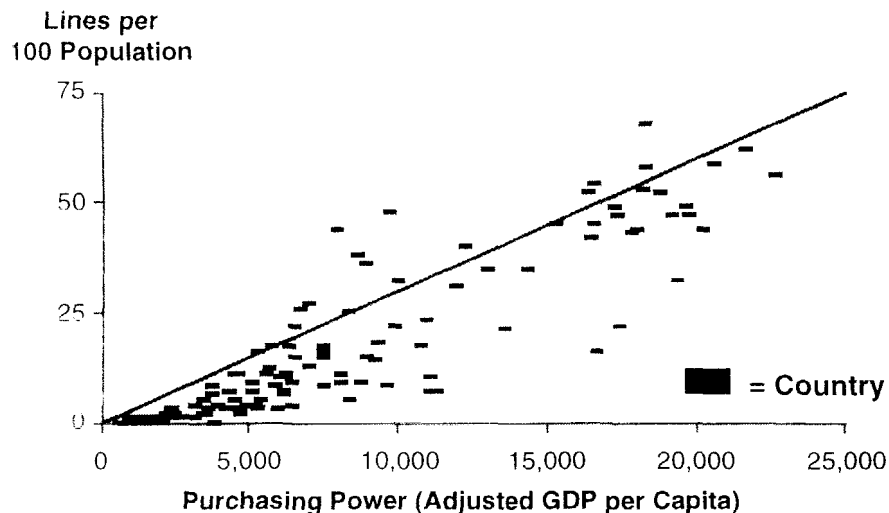
## ***Affordable, High Capacity***

**SPACEWAY™ system capacity ensures more affordable prices than mobile alternatives**

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# ...Fulfilling the Needs of the Underserved

## Telephony Services

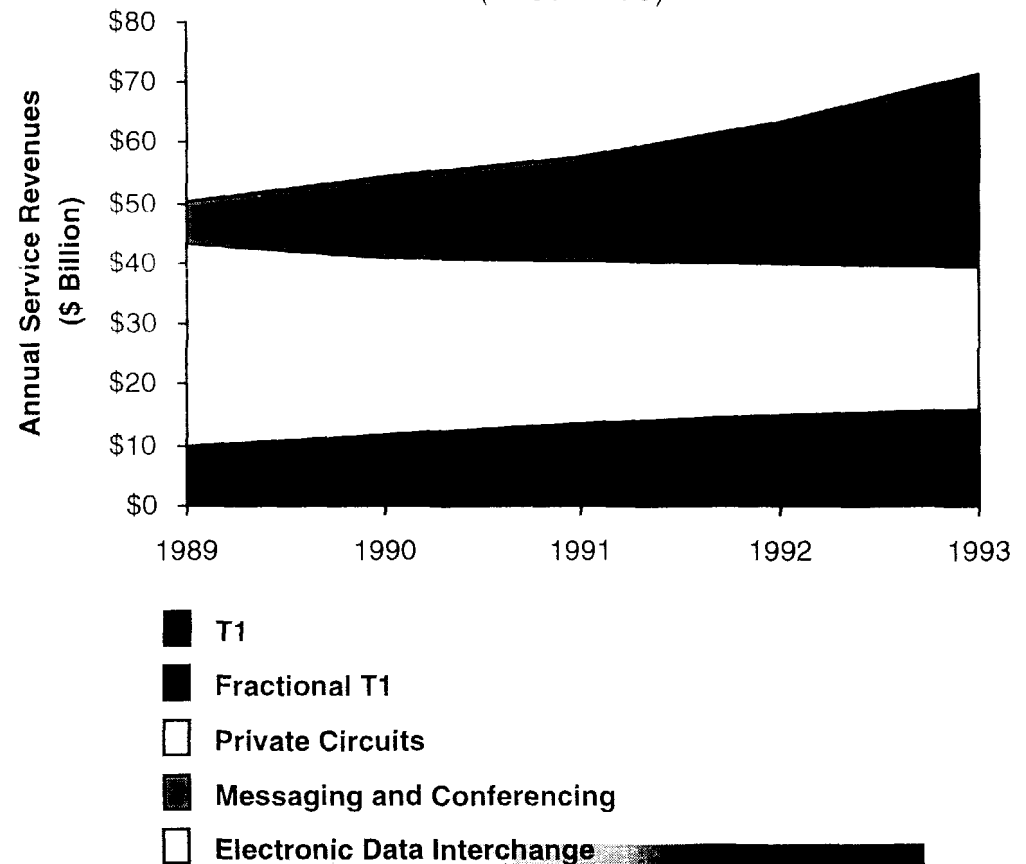


- 90% of the 600,000 villages in India have no form of telephone service.
- "To better serve their 1.2 billion population and exponential economic growth, they [China] are annually adding approximately 10 million new main lines, 500,000 new mobile subscribers, 5 million new paging subscribers...."

—Telecommunications Industry Association

## Wideband Services

### Global Wideband Market Growth (1989-1993)



# INCREASED TRANSMISSION RATE

## SPACEWAY<sup>TM</sup> OFFERS HIGH DATA RATES

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COMMUNICATIONS

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<u>DOCUMENT</u>	<u>INFORMATION</u>	<u>PHONE LINE</u> (9.6 kbps)	<u>SPACEWAY<sup>TM</sup></u> (384 kbps)	<u>SPACEWAY<sup>TM</sup></u> (1.5 Mbps)
PHOTO	1 MBIT	1.7 MIN	2.6 SEC	0.7 SEC
CAD/CAM	2 MBITS	3.4 MIN	5.2 SEC	1.4 SEC
CT SCAN	5.2 MBITS	9.0 MIN	13.5 SEC	3.4 SEC
X RAY	12 MBITS	21.0 MIN	31.3 SEC	7.8 SEC



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# **SPACEWAY™ High Capacity for Each Region**

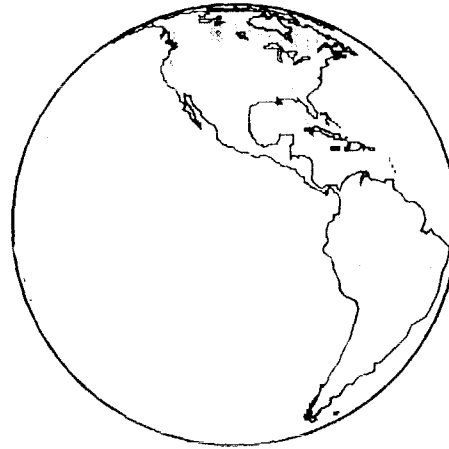
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**HUGHES**

**Each satellite provides:**

- **Reliable service throughout region**
- **Basic telephony/fax and wideband data for multimedia applications**
- **6 GHz effective bandwidth per satellite using polarization and spatial reuse**

**North America**



**Asia-Pacific**



**Central & South America**



**Europe & Africa**



**SPACEWAY™ CAPACITY SUMMARY**  
**SIMULTANEOUS SIMPLEX CIRCUITS**

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**COMMUNICATIONS**

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	<u>16 kbps</u>	<u>128 kbps</u>	<u>384 kbps</u>	<u>1544 kbps</u>
<b>SINGLE FOOTPRINT</b>	<b>9,600</b>	<b>1,440</b>	<b>480</b>	<b>120</b>
<b>ONE SATELLITE</b>	<b>230,400</b>	<b>34,560</b>	<b>11,520</b>	<b>2,880</b>
<b>REGIONAL SYSTEM (4 SATELLITES)</b>	<b>921,600</b>	<b>138,240</b>	<b>46,080</b>	<b>11,520</b>
<b>WORLD WIDE SYSTEM (17 SATELLITES)</b>	<b>3,916,800</b>	<b>587,520</b>	<b>195,840</b>	<b>48,960</b>

# **ROBUST MARKETS**

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COMMUNICATIONS

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## **PRIMARY APPLICATIONS:**

- **INFRASTRUCTURE ENHANCEMENT**
  - › **TELEPHONY**
  - › **FAX / DATA**
  - › **TRANSACTION PROCESSING (VSAT SERVICES)**
- **INTERACTIVE MULTIMEDIA**
  - › **HIGH SPEED DATA TRANSFER (LAN INTER-NETWORKING)**
  - › **VIDEO CONFERENCING (DESKTOP & GROUP)**
  - › **DISTANCE LEARNING**
  - › **TELE-IMAGING / TELEMEDICINE**
  - › **TELECOMMUTING**

## **SECONDARY APPLICATIONS**

- **BROADCAST QUALITY VIDEO (REGIONAL DTH, HDTV)**
  - **HIGH SPEED DATA DISTRIBUTION (VIDEO)**
  - **MULTICASTING / DATA CASTING**
  - **IMMEDIATE INFRASTRUCTURE (EMERGENCY / RAPID DEPLOYMENT)**
-

# Markets and Applications

**HUGHES**

Videoconferencing  
Tele-imaging  
Database Retrieval  
Transaction Processing  
LAN-to-LAN  
Tele CAD

Healthcare	✓	✓	✓				✓	✓
Telecommuters	✓		✓					
Retail/Franchise			✓			✓	✓	
Professional Services	✓		✓					
Construction Contractors		✓						



# Markets and Applications (Continued)

**HUGHES**

	Videoconferencing	Tele-imaging	Database Retrieval	Transaction Processing	LAN-to-LAN	Tele CAD
Agriculture	>		>			
Luxury Homes	>		>			
Banks	>			>	>	
Manufacturing	>					>